tached to the isthmus; four gills with narrow laminæ and scabrous clavate gill-rakers, which, to the number of about ten, are a little elongated on the outer side of the first arch; no pseudobranchiæ.

Body and head, including the glosso-hyal region and the branchiostegal membranes, covered with deciduous membranous cycloid scales of moderate size.

The scales of the very conspicuous lateral line are adherent and greatly enlarged; they lie beneath a continuous sheath of black skin, which is loopholed over a long narrow groove with raised margins situated along the vertical diameter of each scale. These grooves are filled with an opaque white substance, which probably has a luminous function. The lateral line, in fact, is exactly similar to that of several species of *Halosaurus*.

The dorsal fin, which begins just in advance of the gill-opening, and the anal, which begins almost a head-length behind the same level in the adult, are confluent with the pointed caudal. The narrow, pointed pectorals are as long as the rostrorbital portion of the head. There are no ventral fins whatever.

The stomach is siphonal, with a bulbous pyloric end; the intestine, which is very long, is looped and coiled, the loops being held by a stout mesentery; there are six small cæca in a semicircle round the pylorus; no air-bladder can be detected.

Colours in the fresh state uniform jet-black.

Two females, 15·5 and 11·75 inches long respectively, from Station 112, 561 fathoms; a third specimen from Station 116, 405 fathoms.

This extraordinary form seems almost entitled to rank by itself in a separate subfamily of the Ophidiidæ. In general appearance and in most of its structural details it has the closest resemblance to the typical *Brotulina*; but it differs from them all in its remarkable *Halosaurus*-like lateral line and in the entire absence of ventral fins.

[To be continued.]

III.—*Notes concerning the Anatomy of certain Rotifers.*

By Rupert Vallentin.

[Plates IV. & V.]

It was originally my intention to prepare for publication a series of papers concerning the anatomy of some of our larger species of common Rotifers whose structure I had been able

to examine by means of serial sections. After making a careful study of my sections I soon saw that some features which were plainly visible in one Rotifer were often indistinguishable or nearly so in the remaining specimens; hence I deemed it necessary to gather what remarks I had to offer into a single communication.

Having resided for some years in the neighbourhood of Epping Forest, where, in the numerous ponds, one has no difficulty in securing at most times of the year such well-known forms as *Melicerta ringens*, *Stephanoceros*, &c., I was astonished on taking up my residence in Cornwall to find these Rotifers absent from the numerous ponds in the county, and at first imagined that a more diligent search was only necessary to secure them. However, after examining during the past two years at fixed intervals a large number of ponds and pools to all appearances most favourably situated, I have, up to the present time, been only able to find *Brachionus rubens* in any quantity.

Within the past six months I introduced into a pond in the neighbourhood of Falmouth some fine healthy specimens of *Melicerta conifera* procured from Epping Forest. The weed, *Chara vulgaris*, to which the cases containing the Rotifers were attached, flourished and grew luxuriantly; but the Rotifers soon died from some cause I am unable to discover. This fact may in some measure be due to the mildness of the climate here, frosts of any degree of severity being unknown.

The specimens whose structure I have examined by means of serial sections are as follows:—*Melicerta ringens*, *M. conifera*, *Brachionus rubens*, and *Lacinularia socialis*.

I propose in the following paper to discuss in as brief a manner as possible the various points of interest that have presented themselves to me during a close examination of sections of the above-named Rotifers, and to refer the reader to Dr. Hudson's monograph (1)* for a detailed account of each species.

Nervous System.

Melicerta ringens and *M. conifera*.
(Pl. IV. figs. 1–8.)

A close examination of serial sections has failed to reveal to me any material difference between these two species as regards the structure of the central nervous system.

M. Joliet (2) was the first investigator who discovered the

* The numbers refer to Bibliographical List at end.

central nervous system in *Melicerta ringens*. He says :— " Sur la face dorsale du pharynx, immédiatement au-dessus de l'amas glandulaire dépendant du système excréteur, se voient deux ou quatre cellules transparentes qui occupent précisément la position où l'on a décrit le ganglion chez tous les Rotateurs où il a été vu. Elles sont pourvues d'un noyau volumineux qui leur donne beaucoup l'apparance d'une cellule nerveuse et deux d'entre elles envoient un filet à l'organe tactile impair."

I have placed in my illustrations a section taken through the middle of the brain and surrounding parts of *M. conifera*. I have selected this Rotifer mainly on account of its size and the ease with which one can see the nerve-cells. In *M. ringens* the brain is, as stated by M. Joliet, small, the nerve-cells being not nearly so numerous as in *M. conifera* (*vide* Pl. IV. figs. 2–4 and the accompanying explanations).

Lacinularia socialis. (Pl. V. figs. 9–13.)

Dr. Hudson in his monograph gives a summary of our present knowledge concerning the nervous system of this species. He says (*loc. cit.*), " Prof. Huxley describes and figures a ciliated cup beneath the chin, just as in *M. ringens* ; and below this cup, underneath the surface on the ventral side ' a bilobed homogeneous mass resembling in appearance the ganglion of *Brachionus*.' This organ he supposes to be the true nervous ganglion. Dr. Leydig, on the other hand, points out two nucleated polar cells, giving off threads, just below the mastax, and two similar ones at the junction of the foot and trunk."

According to my observations I find a group of nerve-cells placed immediately beneath the transverse band which connects above the mouth the paired lateral excretory tubes (*vide* Pl. V. fig. 12). This group of cells consists of unipolar ganglion-cells. On reference to fig. 12 and the accompanying explanation it will be further noticed that from the dorsal edge of this nervous mass nerve-fibres are given off which ultimately terminate in one of those large cells placed at regular intervals along the inner edge of the corona, and classed under the head of " vacuolar thickenings " by Prof. Huxley (3).

Prof. Huxley says concerning these " vacuolar thickenings " as follows :—" . . . the thickenings in the trochal disk are mostly towards its lower surface and at its inferior margin ; they are generally four or five on each side, and are connected by branched filaments with that body on each side of the pharyn-

geal mass in which the band of the water-vascular system terminates." In this species of Rotifer tactile organs have never been observed; I take these "vacuolar thickenings" to be nerve sense-cells and to perform the function of tactile organs. Occupying the position they do, on any foreign body coming into contact with the expanded edge of the corona the stimulus would be immediately conveyed through these marginal sense-bodies along the nerves and so to the brain. There is, however, a very close connexion between the marginal sense-cell and the dilated portion of each lateral canal in the corona. I have, however, satisfied myself that the nerve-fibre in each instance runs over the dilated portion of the lateral canal and so joins the brain. Be this as it may, cells similar in structure but not showing any connexion with the central nervous mass are also visible in the trochal disk of *Melicerta ringens*, *M. conifera*, and *Brachionus rubens*.

Attention may here be directed to a group of cells placed in the region of the anterior third of the foot. Dr. Leydig (4) gives a very exact representation of these cells as seen in optical section. From a close scrutiny of Dr. Leydig's figure one would be inclined to imagine that these cells were placed immediately beneath the cuticle of the animal. Serial sections, however, show these cells to be grouped together in the central space (body-cavity) of the foot, the longitudinal muscles with the mucous cells forming a complete wall round them (*vide* Pl. V. fig. 9). Each cell is seen to be oval in outline and possessing a nucleus and nucleolus. Anteriorly and posteriorly from each cell processes are given off, the processes from the anterior region of each cell being lost in the viscera, while posteriorly they appear to unite with the muscles forming the attached extremity. These processes are so extremely fine as to render it difficult for one to trace them to their destination. Dr. Leydig takes these cells to be nervous in function. Dr. Hudson (*loc. cit.*), after giving a summary of the researches of previous investigators concerning the position of the known nervous centres in other Rotifers, seriously questions Dr. Leydig's statement concerning the function of the cells in question. At present I think we must own we are unable to offer any satisfactory explanation concerning their function.

Muscular System.

Melicerta ringens and *M. conifera*.
(Pl. IV. figs. 1–8.)

So far as I can discover there is no difference in the

arrangement and distribution of the muscles in these two species.

Prof. Williamson (5) says, "Distinct muscular bands occur at intervals in the common tegument, concentrically encircling the entire organism. Their action is easily observed. Still larger and more distinct fasculi run lengthwise; some of these proceed from the upper part of the visceral cavity to the base of the tail or peduncle, where they are inserted into a thickened portion of the integument. Others, taking their rise from the various parts of the body, proceed along the caudal prolongation, and are inserted into a little concavo-convex body at its extremity."

Dr. Hudson says, "The longitudinal muscles, as in the Floscullariadæ, run up the foot to its junction with the trunk, where they are fastened. They then cross the trunk till they reach the neck, where they are again fastened; and as they reach the head they divide into branches, which cross the lobes of the corona, and, by their contraction, furl it. Transverse muscles, imbedded in the integuments, encircle the trunk; and, by the compression of the body-fluids, drive out and unfurl the corona, just as in *Floscularia*."

M. Joliet gives, according to my observations, the most exact description of the arrangement and number of muscles in this species. He says, under this heading, "Il se compose principalement de huit cordons musculaires, qui vont s'insérer, d'une part, à l'extrémité de la queue qu'ils parcourent dans toute sa longueur, et de l'autre symétriquement à différents niveaux sur la face ventrale, sur la face dorsale, et sur les côtés du corps."

On reference to fig. 7 and the accompanying explanation one cannot fail to notice that the muscles in the foot of this species are arranged in a manner distinctly different to that of any ordinary tube-dwelling Rotifer; and, further, the muscles present in transverse section an almost crescentric outline, appearing to be united by sarcolemma only when viewed in longitudinal section. It will also be noticed that the muscles are placed some distance from the cuticle and not arranged in any order, but appear to move freely in the large body-cavity space in the foot. As to whether or no these features are in any way caused by the reagents used I am unable to determine; still all my sections agree as to these points. Posteriorly, owing to the tapering form of the foot, the muscles tend to converge, and in the region of the posterior third they unite and form the attached extremity. At the junction of the foot with the trunk the muscles form the usual four pairs, and, continuing anteriorly, remain unaltered

till the region of the anterior third is reached. In this latter region the muscles break up and terminate at the base of the corona. Owing to their extreme fineness I am unable to trace these muscles with any degree of exactness in this region. One point, however, is certain; the fibres terminate in a large muscular band placed at the base of the corona.

I may here add in conclusion that I have been unable to discover any traces in section of the circular muscular bands which so many investigators have seen in optical section.

Lacinularia socialis. (Pl. V. figs. 9–13.)

Prof. Huxley in his paper does not appear to notice beyond a brief reference the muscles in this Rotifer; Dr. Leydig, on the other hand, treats this subject in an exhaustive manner. He says (*loc. cit.*): "Es sind vier Längenmuskeln, welche sich durch den ganzen Körper ziehen, von der Spitze des Schwanzes bis zum Rande des Räderorganes und welche die Hauptbewegung des Thieres besorgen, das sich Verkürzen und Einstülpen. Sie sind nicht gleich dick nach ihrer ganzen Ausdehnung: im Schwanzanhang und im Hinterleibe beträgt ihr Durchmesser 0·004‴, nach vorne zu verjüngen sie sich allmälig, und wenn sie einmal in das Räderorgan eingetreten sind, so gehen sie strahlig auseinander zum Rande desselben." He then proceeds to notice certain circular muscles. He says: "Der Leib des Thieres wird auch ringförmig eingeschnürt. Dieses bewerkstelligen eine Anzahl Ringmuskeln, welche in Abständen unter der Haut herum laufen; sie sind viel feiner als die Längenmuskeln, haben auch nie eine Querstreifung, sondern zeigen sich nur als durchaus homogene Fäden. Die einzelnen Ringmuskeln scheinen auch untereinander durch zarte Ausläufer verbunden zu sein."

Serial sections have failed to reveal to me any trace of these circular muscles encircling the body in any way.

I find the arrangement of the muscles in the foot of this species to differ but in a slight manner from that of *Stephanoceros*.

Examining a transverse section taken immediately beneath the junction of the foot with the trunk (*vide* Pl. V. fig. 9), the muscles are found to be six in number, the interspaces being occupied by a prominent mucous cell. It will be further noticed that the muscles are not placed immediately beneath the cuticle, but occupy a position slightly removed from it.

At the junction of the foot with the trunk each muscle divides into two parts. These muscles continue to run anteriorly immediately beneath the cuticle without any visible

alteration, and terminate at the base of the corona or trochal disk.

Alimentary Canal.

Melicerta ringens and *M. conifera*.
(Pl. IV. figs. 1–8.)

All previous investigators have noticed a paired structure visible above the mastax. It is found to be present in the majority of Rotifers. Dr. Hudson (1) says concerning this structure in *M. ringens* as follows:—"On each side of the buccal funnel and above the mastax is a clear organ whose surface is spheroidal. The two have been described as salivary glands by some observers, and as mere stays to the mastax by others. They are obviously elastic, and move up and down with its every motion." Although these paired structures are easily distinguishable in the Rotifers included in the present paper, I find their structure most easily deciphered in *Melicerta conifera*. It is my intention to take this species as an illustration and to describe the structure of these bodies as briefly as possible.

On reference to Pl. IV. figs. 1 and 2, which are serial sections, it will be noticed that, placed immediately above these "spheroidal bodies," are certain glandular cells; the protoplasm being wanting in many instances, these cells were probably in an active state of secretion at the death of the animal. Attached to the inner wall of each "spheroidal body," or, as I shall in future call it, salivary receptacle (for that is what I take them to be), is a valvular body, which places the cavity of each receptacle in immediate connexion with the gut (fig. 2, *a*). It will also be noticed that there is a slight deposit of secretion visible within each salivary receptacle. Dr. Hudson noticed these valvular openings. He says, "It [the buccal funnel] is ciliated throughout, and has a pair of chitinous lips similar to those described at p. 6." The reference given refers to a lengthened description of these structures as they are found in *Brachionus rubens*. Dr. Hudson here says, "But it is not every atom whirled down the buccal funnel that is suffered to reach the mastax; for there are two lip-like processes rising from the mastax, which can be seen every now and then thrust up and down the buccal funnel; and which by closing prevent the passage of morsels that are not to the Rotiferon's taste."

It seems to me highly probable that Dr. Hudson has slightly misplaced the point of attachment of these valvular

or lip-like processes. On reference to fig. 2 it will at once be evident that the real point of attachment of these bodies is on the outer or ventral edge of each salivary receptacle. In addition to this the same figure also shows a connexion between the salivary receptacle (on the left side facing the observer) and the gut. The connexion which exists on the right side is not shown in the drawing, owing to the section not being exactly transverse.

In my opinion the series of complicated movements so exactly described by Dr. Hudson is none other than the opening and closing of these valvular bodies, to allow the secretion to flow into the gut as food is passing, in order to assist digestion.

Prof. Williamson (5) mentions in his paper a structure which seems to have eluded the scrutiny of observers ever since. He says, "Two or three pyriform glandular (?) looking bodies are often attached to the base of the upper stomach, near the constriction which separates it from the lower one. . . . Not having been able to trace any ducts or orifices passing from these organs to the viscera, I have hesitated to assert their glandular character." Dr. Hudson does not appear to have seen these bodies, as he fails to notice their presence.

I have placed in my illustrations a view of this group of cells as seen in longitudinal section to confirm Prof. Williamson's discovery (*vide* fig. 8). At present I am unable to offer any suggestion as to what function they perform, as I have failed to find any opening into the gut.

As to the presence of Mr. Gosse's ". . . little granular body connected with the tip (of the foot) by a point, and enlarging at the upper end, where it is connected with a small globular vesicle," I have been unable to discover a single trace of its presence in section; and in my opinion it does not exist.

Mastax.

Melicerta ringens and *M. conifera.*

From the earliest days of microscopical investigation the mastax has, perhaps, of all the organs attracted the most attention. Originally taken for a heart, Prof. Ehrenberg clearly demonstrated its function in the early part of the present century. At a later period *M. ringens* formed the subject for a most detailed examination by Prof. Williamson, his paper being illustrated with some excellent figures. Mr.

P. H. Gosse (6) followed Prof. Williamson with a short paper on the same Rotifer in the same number of the same journal. A few years later he (Mr. Gosse (7)) published an elaborate treatise, furnished with numerous illustrations of the mastax, with the contained hard parts, in various species of Rotifers, this last work having since then formed the standard work of reference in connexion with this organ. In this last-named work Mr. Gosse, after giving a short summary of Prof. Williamson's investigations in connexion with the structure of the mastax, concludes as follows:—"He [Prof. Williamson] further states, that 'the conglobate organ in which the apparatus is imbedded [*i. e.* the mastax] is composed of numerous large cells, each of which contains a beautiful nucleus with its nucleolus.' . . . The statement of the cellular character of the mastax, and the presumption of penetrating muscles, are alike negatived by my observations, not only in this species, but in the whole range of the Rotifera. The able and learned Professor has probably been misled, in the former conclusion, by some overlying tissues, perhaps similar to the salivary glands in *Euchlanis*." With reference to the mastax, taken as a whole, Mr. Gosse says: "In substance it varies from a state in which its walls are thick and solid, composed of dense muscular fibre, with little cavity, as in *Brachionus*, to one in which it forms a capacious sac, with thin, apparently membranous, parietes, as in *Furcularia*. . . . In *Brachionus urceolaris* it (the mastax) is a dense, colourless, highly refractive mass of muscles. . . ."

Dr. Hudson makes remarks of a similar nature in his description of *Brachionus rubens*. He says: "Muscles, springing from the walls of the mastax, are attached to various parts of the mallei and rami, and act so as to cause the unci to approach and recede from each other."

A careful examination of serial sections taken through the mastax and the surrounding parts of *Brachionus rubens*, *Melicerta ringens*, *M. conifera*, and *Lacinularia socialis* has failed to reveal to me the slightest trace of the muscular investment described and figured by Mr. Gosse and other investigators.

Considering the crude methods employed by Prof. Williamson when he made his important discovery of the cellular character of the mastax, one can readily excuse the position in which he imagined these cells to be placed, for sections show these cells to be placed within the hard parts of the trophi, and not on the walls of the mastax. I have placed in my illustrations an almost complete series of drawings of sections taken through the anterior third of *Melicerta conifera*. I have

selected this species mainly on account of its size and also because of the ease with which one is able to study the sections. I have, however, deemed it prudent to include in my illustrations a nearly median transverse section through the mastax of *Melicerta ringens*. In this species (*M. ringens*) the cells in the hard parts of the trophi are perhaps better shown than in *M. conifera* (*vide* Pl. IV. fig. 4). Turning now to the movements of the mastax, Mr. Gosse notices his previous observations (6) and selects *Limnias ceratophylli* for a detailed examination. He says: "The mastax consists of three subglobose lobes . . . one on each side appropriated to each malleus, and a third descending towards the ventral aspect, which envelopes the incus. The mallei are . . . intimately united to the rami of the incus . . . each uncus forming, with its ramus, a well-defined mass of muscle, enclosing the solid parts, and in form approaching the quadrature of a globe: two flat faces opposing and working on each other."

My own opinion is that there is only one pair of muscles present in the mastax. On reference to Pl. IV. fig. 3 it will be seen that each half of the manubrium is connected with its fellow by a comparatively thick arching band which stretches over the dorsal region of the mastax. Attached to this band on either side of the median line is a muscle, which I have figured slightly more prominently than it really is in section, which, running across each half of the ramus at an obtuse angle, terminates at the extremity of the fulcrum (*vide* fig. 3, *fm*). The movements of these various parts are as follows:— By the simultaneous contraction of the preceding muscles the rami are drawn upwards and inwards, and by the relaxation of the same muscles the rami are forced apart by the semicircular band acting on them.

I may add finally that I have been unable to discover any muscular fibres penetrating the mastax.

Excretory System.

Flame-cells or Vibratile Tags.

Concerning the structure of these singular bodies there has been and still exists a considerable difference of opinion. A summary of our present knowledge concerning the structure of these bodies with their lateral canals is given by Dr. Hudson in his monograph, forming an appendix to the first volume. His description is too long for me to give at length; it may, however, be briefly summarized as follows:—

The structure of a flame-cell or vibratile tag is found to alter in appearance from whichever point it is observed.

Is there a single cilium within the tag, or are there minute cilia, as suggested by Dr. Moxon, "on each inner broad surface of the tag"?

"The next point," says Dr. Hudson, "is whether these tags are opened or closed at their free ends."

Mr. Jackson, in his edition of Rolleston's 'Forms of Animal Life,' says:—"They [the lateral canals] carry a number of ciliated organs, each of which consists of a pyriform canalicule, lodging at its free broad end a flame-cell. The canalicule is closed (Plate) or has a lateral aperture (Echestein)."

It seemed to me hopeless to attempt to arrive at any satisfactory conclusions concerning the structure of a flame-cell by employing the same means as hitherto employed; the attack to be successful must be made from another quarter.

Brachionus rubens is a very common Rotifer, and fortunately possesses flame-cells of considerable dimensions. After several failures I succeeded in preserving a gathering of these Rotifers in a fairly expanded condition, and also in cutting sections of them. In this species of Rotifer I find an individual flame-cell to consist of a hyaline cylinder, the extremity of which is rounded and closed, a single cell possessing a nucleus forming the distal termination. Springing from the centre of this cell and projecting forwards to almost the junction of the flame-cell with the lateral canal is a tapering broad-edged cilium, which has a free motion in the interior of the cell. The junction of the flame-cell with the lateral canal is marked by a fine granular deposit on the walls of the canal (*vide* Pl. V. fig. 14).

Lateral Canals.

The minute structure of these canals is a point to which but little attention appears to have been hitherto directed. The only reference which I can find relating to the minute structure of these canals is by Mr. Jackson. He says: "These tubes [lateral canals] have nucleated walls and are probably intracellular." The structure of these canals is most easily distinguishable in *Lacinularia socialis*. On reference to fig. 10 A, and the accompanying explanation, the walls of the lateral canals are seen to be lined with large cells, each cell being furnished with a distinct nucleus and nucleolus.

There is, however, one important portion of the lateral

canals in *Lacinularia socialis* to which I think sufficient attention has not been hitherto directed. Placed within the ciliary wreath or corona, on either side of the oral aperture, is a dilated portion of the lateral canals. A continuation of the lateral canal extends over the mouth, and joins the corresponding dilatation on the other side. Concerning this dilated portion of the lateral canals Prof. Huxley (3) says in a footnote as follows:—"The only discrepancy of importance in Leydig's account is, firstly, that he considers what I have called the 'vacuolar thickening on each side of the pharyngeal mass,' and what Ehrenberg calls a nervous centre, to be formed by convolutions of the water-vessel itself . . . Leydig does not seem to have noticed the transverse anastomosing vessel over the pharynx."

After a careful study of my sections through these dilated portions of the lateral canals I believe their structure to be as follows:—On reference to Pl. V. fig. 11 and the explanation accompanying it the course of a lateral canal can be easily traced for some considerable distance in the dilated portion, and then suddenly terminates. As to whether or no there is a ciliated opening at the point where the canal abruptly terminates I am unable to satisfy myself. Be this as it may, the tube continues, and, uniting with the transverse branch, runs over the ganglion and unites with its fellow on the opposite side. The character of the tissue which surrounds these convoluted tubes appears to be of a spongy nature with scattered nuclei (*vide* figs. 11 and 12). As to whether or no actual secretion takes place in this region, I am unable at present to determine.

As to whether or no the lateral canals finally open into the cloaca or possess a separate opening to the exterior, investigators have concerning this point differed greatly in opinion. Prof. Huxley says: "There is no contractile sac opening into the cloaca as in other genera, but two very delicate vessels, about 1-4000th of an inch in diameter, clear and colourless, arise by a common origin upon the dorsal side of the intestine. Whether they open into this, or have a distinct external duct, I cannot say." Dr. Hudson, after giving a short summary of Prof. Huxley's remarks, says:—". . . but Dr. Leydig says that the lateral canals start from a common branch opening into a contractile vesicle, which discharges itself into the cloaca: it will be seen that a similar doubt exists concerning the termination of the canals in *Conochilus volvox*, and further investigation is, I think, wanted to make the matter clear."

After examining many dozens of sections taken through

Lacinularia socialis, I at last succeeded in obtaining one series of sections that left no doubt on my own mind as to the final termination of the lateral canals. On reference to fig. 13 the thin membranous-like termination of the united lateral canals will at once be seen. The slightly dilated junction rapidly narrows and opens to the exterior immediately beneath the anal aperture (fig. 13, *e*). I think the extreme difficulty one experiences in viewing in a satisfactory manner the termination of these lateral canals is mainly owing to the extreme delicacy of the walls of the lateral canals in the region of the posterior third to their junction. This statement receives confirmation from the fact that the termination of the lateral canals in all my other sections has eluded my most careful scrutiny.

Literature referred to.

(1) Hudson, C. T., and Gosse, P. H. The Rotifera or Wheel-animalcules. 1886.

(2) Joliet. "Monographie des *Melicertes*," Arch. de Zool. expér. et gén. vol. i. 1883.

(3) Huxley, T. H. "*Lacinularia socialis*: a Contribution to the Anatomy and Physiology of the Rotifera," Trans. Micr. Soc. Lond. vol. i. 1853.

(4) Leydig, F. "Zur Anatomie und Entwicklungsgeschichte der *Lacinularia socialis*," Zeitschr. f. wiss. Zool. iii. 1851.

(5) Williamson, W. C. "On the Anatomy of *Melicerta ringens*," Quart. Journ. Micr. Sci. vol. i. 1853.

(6) Gosse, P. H. "On the Structure, Functions, Habits, and Development of *Melicerta ringens*," Quart. Journ. Micr. Sci. vol. i. 1853.

(7) ——. "On the Structure, Functions, and Homologies of the Manducatory Organs in the Class Rotifera," Phil. Trans. 1855.

EXPLANATION OF THE PLATES.

List of Reference Letters.

l.c. Lateral canals.
o. Ovary.
s.g. Salivary glands.
S.R. Salivary receptacles.
a. Opening of salivary receptacles into pharynx.
g. Ganglia (brain).
m. Muscles.
m.c. Mucous cells.
ST., *st.* Stomach.
i. Intestine.
c. Cuticle.
gg. Gastric glands.
x. Opening of gastric glands into œsophagus.
œ. Œsophagus.
b.c. Body-cavity.
f.c. Flame-cell.

r.t. Vibratile tag.
m.s.c. Marginal sense-cells of corona.
c.l.c. Coiled portions of lateral canals in the corona.
s. Spindle-shaped cells in foot.
mb. Manubrium.
fm. Fulcrum.
e. External opening of united portions of lateral canals.
d. United terminations of lateral canals.
z. Cells of unknown significance placed between stomach and intestine.
ph. Pharynx.

Plate IV.

Fig. 1. Transverse section of *Melicerta conifera* immediately beneath the base of the corona. Zeiss obj. E, oc. 3.
Fig. 2. Next section of same Rotifer, showing brain and salivary receptacles. Zeiss obj. F, oc. 3.
Fig. 3. Next section but one of same Rotifer, showing mastax and surrounding parts. Zeiss obj. E, oc. 3.
Fig. 4. Transverse section through mastax and surrounding parts of *Melicerta ringens*. Zeiss E, oc. 3.
Fig. 5. Transverse section through œsophagus and surrounding parts of *Melicerta conifera*, showing opening of gastric gland into the œsophagus. Zeiss obj. F, oc. 3.
Fig. 6. Transverse section through the middle of body of same Rotifer. Zeiss F, oc. 3.
Fig. 7. Transverse section of same Rotifer immediately beneath the junction of foot with body. Zeiss F, oc. 3.
Fig. 8. Vertical section through *Melicerta ringens*, showing cells of unknown significance placed between stomach and intestine. Zeiss E, oc. 3.

Plate V.

Fig. 9. Transverse section of *Lacinularia socialis* immediately beneath the junction of foot with body. Zeiss F, oc. 3.
Fig. 10 A. Vertical section through lateral canal of *Lacinularia socialis*. Zeiss F, oc. 3.
Fig. 10 B. Transverse section of *Lacinularia socialis*, showing gastric glands and one duct passing into the œsophagus. Zeiss E, oc. 3.
Fig. 11. Vertical section through margin of corona and surrounding parts of *Lacinularia socialis*, showing marginal sense-cell and coiled portion of lateral canal in the corona. Zeiss F, oc. 3.
Fig. 12. Transverse section through corona of *Lacinularia socialis*, showing brain and nerve-fibres terminating in marginal sense-cells. Zeiss F, oc. 3.
Fig. 13. Transverse section through same Rotifer, showing intestine with its external aperture and external opening of united portion of lateral canals. Zeiss E, oc. 3.
Fig. 14. Vertical section through *Brachionus rubens*, showing flame-cell with portion of lateral canal. Zeiss K, oc. 3.